## REMARKS

The Applicants have carefully considered this application in connection with the Examiner's Action mailed January 3, 2003 and respectfully request reconsideration of this application in view of the following remarks.

### I. Rejection of Claims 1, 4-12, 15- 24 under 35 U.S.C. §103

The Examiner has rejected process Claims 1, 5-6, 8-12, 16-17 and 19-24 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,591,671 to Kim *et al.* ("Kim") in view of U.S. Patent No. 5,714,418 to Bai *et al.* ("Bai") and U.S. Patent No. 5,591,671 to McTeer ("McTeer"). The Examiner further rejected Claims 4 and 15 under 35 U.S.C. §103(a) as being unpatentable over Kim in view of Bai, McTeer and further in view of the Applicant's admitted prior art. The Examiner also rejected Claims 7 and 18 under 35 U.S.C. §103(a) as being unpatentable over Kim in view of Bai, McTeer and further in view U.S. Patent No. 5,970,374 to Teo ("Teo").

The Applicants respectfully maintain that the claimed invention is not obvious in view of the foregoing combined references, and that various combinations of these reference fail to establish a *prima facie* case of obviousness of Claims 1, 5-6, 8-12, 16-17 and 19-24 .

The combination of Kim, in view of Bai and McTeer, for instance, fail to teach or suggest all of the elements of the invention recited in independent Claim1. Claim 1 recites, among other things, subjecting the contact plug to a temperature sufficient to anneal the barrier layer. The Examiner acknowledges that the combination of Kim in view of Bai fails to teach or suggest subjecting the contact plug to a temperature sufficient to anneal the barrier layer, subsequent to forming the plug. For this, the Examiner cites FIGURE 6 in McTeer and the accompanying text

(Column 19, Lines 12-33). The Applicants respectfully disagree that Kim in view of Bai and McTeer teach or suggest subjecting the contact plug to a temperature sufficient to anneal the barrier layer.

McTeer states that the contact structure shown in FIGURE 6 is made by forming an opening through first and second insulating layers 7, 9, over laying the opening with a refractory metal 13, which in turn is overlaid with barrier 4 and wetting 5 layers (Column 19, Lines 12-22). McTeer further states that the opening is then filled with copper 3, annealed and caused to reflow, as described in FIGURE 1 (Column 19, Lines 22-24). FIGURE 1 and its associated text, however, depict a copper layer 3 hot deposited over the entire surface of the substrate 1 and barrier layer 2 (Column 17, Lines 22-58), analogous to the prior art depicted in the FIGUREs 1-2 of the present applicant. McTeer then anneals the copper layer 3 and then causes the copper to reflow at a temperature of greater than about 500°C (Column 17, Lines 50-58). Planarization of the copper layer 3 to form a contact level dual damascene is not done until after the copper layer is anneal and caused to reflow (FIGURE 4; Column 18, Lines 35-58). As such there is no teaching or suggestion by McTeer of subjecting the contact plug to a temperature sufficient to anneal the barrier layer subsequent to removing a substantial portion of the contact metal and barrier layer to form the contact plug. Therefore, the combination of Kim in view of Bai and McTeer fails to teach or suggest teach or suggest all of the elements of the invention recited in independent Claim1.

The Applicants further submit that the combination of Kim in view of Bai is improper because one of ordinary skill in the art would have no motivation to find or add to Kim the teachings and suggestions of Bai. The Examiner asserts that Bai teaches extending the plug to an uppermost surface of the substrate, and that Bai is properly combinable with Kim because Bai would result in

a planarized interconnect with reduced contact resistance and improved performance of the circuit (Examiner's Detailed Action, Page 3 Lines 4-13). The Applicants respectfully disagree that there is motivation to combine the above-described teachings of Bai with Kim.

The text of Bai cited by the Examiner (Columns 9, Lines 26-42) makes clear that the reduced contact resistance associated with the electrical interconnect of FIGURE 4D is due to the larger cross-sectional area of the interconnect as compared to prior art interconnects (FIGURE 2). The greater cross-sectional area of the interconnect is due to Bai's use of a thin diffusion barrier as compared to the prior art (Column 2 Lines 56-64; Column 8, Lines 48-57). There is no teaching or suggestion whatsoever that extending the interconnect to an uppermost surface of the substrate has anything to do with asserted advantages of Bai's invention. Therefore, because one of ordinary skill would have no motive to combine Bai's interconnect with Kim, this combination is improper.

In summary, the combined teachings of Kim in view of Bai and Lee do not teach or suggest all elements of the present invention and are not properly combinable. This combination of references, therefore fail to establish a *prima facie* case of obviousness with respect to independent Claim 1, as well as independent Claims 12 and 24, which contain analogous elements as Claim 1, or their respective dependent claims, under 35 U.S.C. §103(a). The Applicants therefore respectfully request the Examiner withdraw the rejection and allow Claims 1, 4-12, and 15-24.

## III. Conclusion

In view of the foregoing remarks, the Applicants now see all of the Claims currently pending in this application to be in condition for allowance and therefore earnestly solicit a Notice of Allowance for Claims 1, 4-12 and 15-24.

The Applicants request the Examiner to telephone the undersigned attorney of record at (972) 480-8800 if such would further or expedite the prosecution of the present application.

Respectfully submitted,

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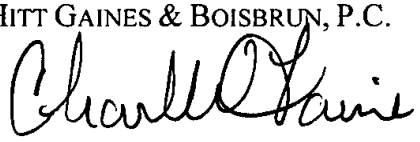

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